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AUTHOR Hick, Thomas L.; And Others
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ABSTRACT

This paper is a technical report of analyses carried out to determine the effects of parents' involvement in a prekindergarten program on their children's cognitive development. The research was part of a longitudinal study of the New York State Experimental Prekindergarten Program. A multiple linear regression approach was used to test hypotheses of interest. The analysis was designed to determine whether the number of hours of parent involvement was related to cognitive development, whether the relationships were curvilinear, whether there were interactions between variables, and whether the relationships could be explained by other variables, including pretest performance, age, mother's education, and family income. The analysis showed that parent involvement had a favorable effect on general reasoning, school-related knowledge and skills, and knowledge of verbal concepts. The effects were found regardless of the child's age, mother's education, or family income. For general reasoning and school related knowledge and skills, the effects were also found, regardless of the child's score on the same test at the beginning of prekindergarten. For knowledge of verbal concepts, however, the effect of parent involvement tended to be greater for children who were initially lowest in knowledge of verbal concepts. (Author/SS)

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EFFECTS OF PARENT INVOLVEMENT IN A PREKINDERGARTEN PROGRAM ON CHILDREN'S COGNITIVE PERFORMANCE

Thomas L. Hick
David J. Irvine
Mary D. Horan
David L. Flint
Susan E. Kukuk
Edward Fallon

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Prekindergarten Evaluation Unit
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EFFECTS OF PARENT INVOLVEMENT IN A PREKINDERGARTEN PROGRAM ON CHILDREN'S COGNITIVE PERFORMANCE

The New York State Experimental Prekindergarten (PreK) Program serves approximately 5,000 four-year-old children in 53 school districts and Boards of Cooperative Educational Services. As part of a longitudinal study of the program, three measures of cognitive development were administered to the children in the fall of 1975 and to a sample of the children in the spring of 1976. Data were also collected on demographic characteristics, children's attendance, and several program factors. The longitudinal study was designed to identify effects of the program on the cognitive and noncognitive development of children (Evaluation Design, 1975).

THE PROBLEM

The PreK program involves parents in a variety of capacities. The present study was designed to investigate the relation between parent involvement and cognitive performance of children. In addition to studying the overall effects of parent involvement, the study is also concerned with whether parent involvement is more effective for children at different levels of cognitive development and whether apparent effects of parent involvement might be explained by other factors, such as family income, educational level of the parents, or age of the child.

Simply finding a relationship between parent involvement and children's cognitive development does not establish a simple cause-and-effect relationship. Other reasons for what seems to be an effect of

parent involvement are possible. It is a major purpose of this analysis to suggest alternative reasons and to examine them to determine whether parent involvement still remains a good explanation.

The pretest was put forth as one possible factor. Perhaps the mothers who were more involved during the program also gave their children more time before the program started. Any effect of this general inclination to be involved was measured by the pretest as well as the posttest. By using the pretest as a factor, general effects (such as propensity to be involved) that operated before the child entered the program are taken into account.

Age is another factor competing with parent involvement. Perhaps older children have more involved parents. Probably not, but this sort of possibility can be investigated.

Two factors thought to have socioeconomic impact on the general cognitive development of children were also included. One factor, the educational level of the mother, may affect the quality of the mother's cognitive and verbal behavior which could, in turn, affect the development of her child both before and during the program. Mother's education should be examined as it relates to possible effects of parent involvement.

Family income is the other socioeconomic factor considered. It could determine whether the family is able to focus on improving the quality of life or must put all its efforts into merely surviving. For this reason, it warrants investigation as a possible explanation for any effect of parent involvement.

As analysis proceeds, these alternative factors are considered singly, in combinations that form statistical interactions, and in combinations that form complex curves. All these combinations increase the possibility that an alternative explanation for a parent involvement effect will be found if it is present. The effect of parent involvement is the last to be tested so that the competing factors have been examined and taken into consideration.

PARENT INVOLVEMENT

The Experimental Prekindergarten Program operates under guidelines established by the New York State Education Department's Bureau of Child Development and Parent Education. According to the Guidelines, the PreK program

> ...helps children develop their full potential: social-emotional-intellectual- and physical. A major responsibility of the prekindergarten program is to provide a highly individualized, well-balanced program that recognizes each child as a whole and unique human being and places emphasis on the total environment, indoors and outdoors. The use of expressive materials and activities which put a premium on personal choice and invention rather than on response to teacher direction provide a focus on self-initiation and the building of life-connected concepts (State Education Department, undated).

The instructional component of the program requires the child's active participation and stresses auditory and perceptual discrimination, positive self concept, language development, and planning for the future. The guidelines also require the district to provide for the child's physical development, health care services and nutrition education for the family, staff development and inservice education, family social

services, and the inclusion of each child's parents in the program. It is the latter component of the PreK program, that of parent involvement, with which this report is concerned.

The overall aim of the parent involvement component is to enable parents to become adults who are supportive to their children's development. This is to be achieved by: (1) involving parents in the educational process of their children in school and as it relates to the child's education at home, and (2) helping parents make changes in those aspects of home environment which limit children's development.

A part of the evaluation of the PreK program was to investigate the relationship between the involvement of a child's parent in the program and the performance of that child on the various criterion measures. Each time a contact was made between the program and the parent, the number of hours (or minutes) was recorded on the Record of Parent Involvement. A copy of the forms and directions are included here as an appendix. Twenty-two different types of contacts in five categories were delineated on the form. The five categories are: (1) School Visits; (2) Home Visits; (3) Meetings; (4) Employment in Program; and (5) Other Contacts. Records were kept by all staff members throughout the school year and a summary record for each child's parent(s) was submitted at the end of the year to the evaluation staff. While some contacts occur for a definable duration, other contacts--such as reading a teacher's note or a newsletter--do not. In such cases, staff members were instructed to use their best estimate of the duration of the contact. In some instances, the local staff had not made time estimates; then, durations were estimated by the

evaluation staff for certain contacts, such as 5 minutes to read a newsletter or note sent home, 15 minutes per phone call, and 30 minutes to prepare snacks or favors for class.

CRITERION MEASURES

The Walker Readiness Test for Disadvantaged Preschool Children (Walker) was developed as a culture-fair, nonverbal, individually administered test of general reasoning based on perceptual discrimination (Walker, 1969). It was nationally normed on approximately 12,000 Head Start and Community Action Program children ranging in age from 3½ to 7 years. The norming population was from rural and urban communities and was made up of black and white children.

The 50-item test is divided into four parts and yields separate scores for Similarities, Differences, Numerical Analogies, and Missing Parts. A total score is also obtained.

The Cooperative Preschool Inventory, Revised Edition, 1970 (Cooperative) is an outgrowth of Bettye Caldwell's efforts begun in 1965 to develop an "instrument that would provide an indication of how much a disadvantaged child, prior to his introduction to Head Start, had achieved in areas regarded as necessary foundations for subsequent success in school" (Educational Testing Service, 1970). The Cooperative's predecessor was standardized on 1,531 children who participated in Head Start Programs throughout the United States in Fall, 1969.

The test contains 64 items which measure the child's knowledge about his personal world, ability to interact with another person, vocabulary,

numerical concepts, awareness of the physical properties of common objects, and ability to execute certain visual-motor tasks.

The Peabody Picture Vocabulary Test (Peabody) was included in the evaluation as a measure of the child's receptive (or hearing) vocabulary. It was developed by Lloyd Dunn in 1958 and standardized on 4,012 children in Nashville, Tennessee, ranging in age from 2½ to 18 years. The Peabody contains a total of 150 items; however, the actual number of items given to an individual depends upon the child's ability. The number of items administered to any one child ranges from 14 to perhaps 50. The test yields Mental Age and I.Q. scores; however, for purposes of the present study, the raw scores were used in the analysis of data.

A more detailed discussion of these measures may be found in the Evaluation Design (State Education Department, 1975).

ANALYSIS

A multiple linear regression approach was used to test hypotheses of interest, following procedures suggested by several authors (Cohen, 1968; McNeil, Kelly, & McNeil, 1975; Kerlinger & Pedhazur, 1973). This approach generates a full model, which includes all of the predictor information, and a restricted model, which leaves out some of the information in the predictor set. The significance of the information left out is obtained by testing the difference between the R-squares of the two models with the F statistic.

An analysis system was conceptualized and implemented to establish whether the number of hours of parent involvement was related to the

criteria, whether the relationship was curvilinear, whether the relationship was involved in an interaction with other variables, whether such interaction was complex curvilinear, and whether any obtained relationships could be explained by the other variables: pretest, age, mother's education and income.

To develop a starting model that expressed all effects of interest, variables were established with one of the cognitive measures as the criterion (Y):

P = Pretest raw score divided by 10.[1]

H = Parent involvement time in hours divided by 100.

A = Age of the child in days at the time of the pretest with 1000 subtracted and then divided by 100.

M = Mother's highest grade completed (educational level).

I = Family income in thousands of dollars.

RESULTS

Effects of Parent Involvement on the Walker.

The average parent was involved in the program for 53.9 hours (Table 1). Involvement ranged from no involvement up to 424 hours. The children averaged 4 years and 5 months in age (1620 days). The youngest was three years and five months old (1255 days) while the oldest was 5 years and 10 months old (2111 days). Mothers had completed an average of 10.8 years of education and family income averaged

[1]Variables were divided to reduce the size of very large sums of cross products for some of the computed vectors and to obtain regression weights that were within the limits of the floating point output fields.

$6,980 per year. On the pretest, the children scored 24.4 right answers on the average and 38.3 right answers on the posttest.

Table 1

Means and Other Statistics for Walker Analysis

Variable	Unit	Min.	Max.	Mean	SD
Walker Posttest	points	9	50	38.3	6.8
Walker Pretest	points	0	48	24.4	9.6
Parent Involvement	hours	0	424	53.9	54.6
Age	days	1255	2111	1620	107.7
Mother's Education	years	0	18	10.8	2.6
Income	dollars	1000	27000	6980	3370

Intercorrelations among the variables are given in Table 2.

Table 2

Correlations for the Walker Analysis

	1	2	3	4	5	6
1. Walker Posttest	1.00	.50	.09	.15	.16	.07
2. Walker Pretest		1.00	.10	.23	.16	.15
3. Parent Involvement			1.00	-.06	.03	-.01
4. Age				1.00	.01	.01
5. Mother's Education					1.00	.18
6. Income						1.00

The application of various hypotheses resulted in the statistical models given in Table 3. All the vectors acting together in Model 1 covered about 28 percent of the variability in the Walker posttest scores. This corresponds with a multiple correlation coefficient of .53 which seems high but there are 27 linearly independent vectors in the model. That this correlation might be zero was tested at Hypothesis 1.

Table 3

Regression Weights[a] for Models in the Walker and Parent Involvement Analysis

Vectors	Models 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
U	43[b]	43	54	32	54	55	32	58	25	28	53	30	27	28	27
P	-1.3	-1.3	- .96	-1.1	-1.1	-1.2	- .92		3.3	- .81	- .89	- .86	3.3	3.3	3.3
P^2	1.9	1.9	2.0	2.1	2.0	2.1	2.0			1.9	1.9	1.9			
P^3	- .26	- .26	- .27	- .28	- .28	- .28	- .27			- .25	- .26	- .26			
H	12	15	2.4	1.9	2.3	2.3	1.9	2.8	2.4	2.2	2.4	2.1	2.6		1.28
H^2	-5.4	-6.5	-1.1	- .70	-1.1	-1.1	- .75	-1.6	-1.1	- .94	-1.2	- .88	- .97		
H^3	.64	.78	.27	.17	.25	.25	.19	.39	.24	.22	.27	.20	.22		
A	-7.6	-8.2	-12		-11	-12		-13	.34	.32	-12	.34	.35	.31	.35
A^2	1.3	1.4	1.9		1.9	1.9		2.5			1.9				
A^3	- .07	- .07	- .10		- .10	- .10		- .14			- .10				
M	- .07	- .01	- .30		- .29		- .26	- .52	.22	.21	.22	- .29	- .24	- .15	- .21
M^2	.03	.03	.03		.03		.02	.05				.03	.02	.02	.02
I	.04	.07	- .04												
I^2	- .00	- .00	.00												
HP	2.5	1.4													
HA	- .07	- .34													
HM	- .59	-1.1													
HI	- .88	- .12													
H^2P	.53	- .60													
H^2A	- .03	.04													
H^2M	.40	.45													
H^2I	- .04	- .03													
PHA	- .18														
PHM	.00														
PHI	- .01														
HAM	- .07														
HAI	.14														

[a]Regression weights are rounded for this table and are not intended for individual prediction or statistical manipulation.

[b]These are raw score regression weights and are not comparable from one model to another or from one weight to another within the same model.

Hypothesis 1: There is no effect of any of the variables.

FULL (1) R^2 = .2788, 27 liv*

REST (50) R^2 = .0000, 1 liv

F = 15.26 with 26/1026 df, P = .0001

Result: Reject the hypothesis.

Rejection of this hypothesis indicates that there was some effect on the Walker posttest. Model 1 expresses some triple interactions that include parent involvement. Any demonstration that triple interaction exists would show that parent involvement is expressing itself in a ver complex manner. This was tested by Hypothesis 2: there is no triple interaction. The resulting F of .38 was not significant, so the hypothesis was retained.

Hypothesis 2: There is no triple interaction.

FULL (1) R^2 = .2788, 27 liv

REST (2) R^2 = .2775, 22 liv

F = .38 with 5/1026 df, P = .8637

Result: Retain the hypothesis.

The testing and retention of Hypothesis 2 indicates that there is no triple interaction. Model 2 adequately explains the variation in the criterion and becomes the new full model. The relationship between the predictors and the criterion has been greatly simplified, because the possibility of five complex effects has been eliminated.

*Linearly independent vectors.

Another large group of complex effects lies in the two-factor interactions that could be either linear or curvilinear with respect to parent involvement. The effect of this group of variables was tested at Hypothesis 3.

Hypothesis 3: There is no two-factor interaction.

FULL (2) R^2 = .2775, 22 liv

REST (3) R^2 = .2689, 14 liv

F = 1.53 with 8/1031 df, P = .1434

Result: Retain the hypothesis.

Retention of Hypothesis 3 produced further simplification. Model 3, which has no interaction among variables, becomes the new full model.

At this point in the sequence of analysis, it is apparent that if there is an effect of parent involvement it is not dependent on the levels of some other variable or combination of variables. For illustration, if children with parents who spend more hours involved in the program score higher on the Walker, then the amount higher is the same for children of mothers with eighth-grade education and for children of mothers with a twelfth-grade education. Likewise, the amount higher is the same for children who score lower on the pretest and those who score higher, those who were younger and those who were older when they entered the program, and the same for children in families with income of $6,000 and for children in families with $10,000 income. So, at this point, it has been found that if there is an effect of parent involvement it is relatively simple, uncomplicated by the initial score on the Walker, family income, mother's educational level and age.

Next, all of the possibly influential variables except the pretest were tested.

Hypothesis 4: There is no effect of age, mother's education, and income.

FULL (3) R^2 = .2689, 14 liv

REST (4) R^2 = .2550, 7 liv

F = 2.83 with 7/1039 df, P = .0063

Result: Reject the hypothesis.

Rejection of the hypothesis indicates that at least one, and possibly more, of these three variables has an effect on the Walker posttest scores. The order of testing the three variables was determined intuitively on the basis of their desirability for inclusion in the model. Thus, the first variables tested was least likely to be retained, since it must add a statistically significant amount of information to the information provided by the other two variables and all the other variables in the model, including the pretest and hours of parent involvement. Correlations between variables provide some clues here (Table 2). Variables that are highly correlated with other predictor variables are not very likely to make a significant contribution to the explanation of criterion variability. This is not the same as concluding that the rejected variable would have no effect if it were the only predictor. In the case of income, the first of the three variables to be tested, the small correlation with the posttest relative to correlations with other predictors suggests that a significant contribution is unlikely.

Indeed, as Hypothesis 5 shows, there is no effect of income in the presence of the other variables.

Hypothesis 5: There is no effect of income.

FULL (3) R^2 = .2689, 14 liv

REST (5) R^2 = .2687, 12 liv

F = .13 with 2/1039 df, P = .8735

Result: Retain the hypothesis.

Mother's educational level was next tested for an effect.

Hypothesis 6: There is no effect of mother's educational level.

FULL (5) R^2 = .2687, 12 liv

REST (6) R^2 = .2609, 10 liv

F = 5.59 with 2/1041 df, P = .0039

Result: Reject the hypothesis.

Rejection of this hypothesis establishes an effect of mother's education that is in addition to any effect of age, pretest, and parent involvement. With mother's education level included in the full model, the hypothesis of no effect of age was tested.

Hypothesis 7: There is no effect of age.

FULL (5) R^2 = .2687, 12 liv

REST (7) R^2 = .2621, 9 liv

F = 3.14 with 3/1041 df, P = .0247

Result: Reject the hypothesis.

At this point, it has been established that there is an effect of mother's educational level and child's age but not of income.

The next variable to be tested was the initial status of the children on the Walker.

Hypothesis 8: There is no effect of the pretest.

FULL (5) R^2 = .2687, 12 liv

REST (8) R^2 = .0768, 9 liv

F = 91.07 with 3/1041 df, P = .0001

Result: Reject the hypothesis.

Rejection of Hypothesis 8 indicates that the pretest has an effect beyond the effects of mother's educational level and age. The effect is quite potent, accounting for about 19% of the variation in the Walker posttest scores. Further simplification of the effects of the variables was sought at this point to achieve a parsimonious model. An attempt was made to eliminate all the control variable curvilinearity with one hypothesis.

Hypothesis 9: There is no effect of curvilinearity among the control variables.

FULL (5) R^2 = .2687, 12 liv

REST (9) R^2 = .2600, 7 liv

F = 2.47 with 5/1041 df, P = .0308

Result: Reject the hypothesis.

Rejection of Hypothesis 9 indicates that some kind of curvilinearity exists. The search began to locate the curvilinearity. Age and mother's education were tested for curvilinearity in Hypothesis 10.

Hypothesis 10: There is no curvilinearity of age and mother's education.

FULL (5) R^2 = .2687, 12 liv

REST (10) R^2 = .2632, 9 liv

F = 2.63 with 3/1041 df, P = .0490

Result: Reject the hypothesis.

Curvilinearity was not eliminated, leading to the conclusion that either mother's educational level or child's age was curvilinear, or that both were curvilinear. Individual tests for curvilinearity were then made.

Hypothesis 11: There is no curvilinear effect of mother's education.

FULL (5) R^2 = .2687, 12 liv

REST (11) R^2 = .2672, 11 liv

F = 2.20 with 1/1041 df, P = .1380

Result: Retain the hypothesis.

Hypothesis 12: There is no curvilinear effect of age.

FULL (5) R^2 = .2687, 12 liv

REST (12) R^2 = .2648, 10 liv

F = 2.83 with 2/1041 df, P = .0595

Result: Retain the hypothesis.

Both of these hypotheses were tested against the same full model. The results conflict with results of testing Hypothesis 10. The overall hypothesis of no curvilinearity (Hypothesis 10) was rejected, but both of the individual hypotheses were retained. One possible source of difficulty might be a high correlation between the two curvilinear vectors

involved, the squares of mother's education and child's age. If this is the case, then it would make sense that neither variable is significant in the presence of the other. To determine this, the effect of the age curve was tested without the presence of the mother's education curve.

Hypothesis 12a: There is no curvilinear effect of age without control for a mother's education curve.

FULL (11) R^2 = .2672, 11 liv

REST (10) R^2 = .2632, 9 liv

F = 2.84 with 2/1042 df, P = .0589

Result: Retain the hypothesis.

Thus, the curvilinearity of age was not demonstrated. As a result of the foregoing three hypotheses, the hypothesis of no curvilinearity of mother's educational level and child's age was rejected.

With linear effects of mother's educational level and age present, the analysis continued with a test for curvilinearity on the pretest. This curve would allow for floor and ceiling effects on the pretest.

Hypothesis 13: There is no curvilinear effect of the pretest.

FULL (12) R^2 = .2648, 10 liv

REST (13) R^2 = .2614, 8 liv

F = 2.40 with 2/1043 df, P = .0916

Result: Retain the hypothesis.

This would occur if the pretest scores were bunched at either the high end or the low end or both. There was no curvilinearity on the pretest.

The model (1) that started the analysis has been greatly simplified. A number of variables and combinations of variables have been tested and eliminated because they do not explain the effect of parent involvement.

In summary, any effect of parent involvement cannot be explained by differences in family income, mother's education, child's age, or combinations of these variables.

Still, the parent involvement effect could be zero. It has not yet been tested.

Hypothesis 14: There is no effect of parent involvement hours.

FULL (13) R^2 = .2614, 8 liv

REST (14) R^2 = .2503, 5 liv

F = 5.23 with 3/1045 df, P = .0014

Result: Reject the hypothesis.

Hypothesis 14 tests for a parent involvement effect. There is an effect of parent involvement that is statistically significant beyond the .01 probability level. It accounts for about one percent of the variation in the Walker posttest scores. Pretest, age, and mother's educational level account for about 25%, leaving about 74% of unaccounted variance.

The form of the parent involvement effect remains to be resolved. The possibility of a curvilinear relationship between parent involvement and the Walker has not been eliminated. Curvilinearity could occur if children tended to bunch near the upper and/or lower end of the range of Walker scores. It could also occur if parent involvement is more

effective for children performing at one level of the Walker than it is for children at other levels. Hypothesis 15 tested for curvilinearity.

Hypothesis 15: The effect of parent involvement is not curvilinear.

FULL (13) R^2 = .2614, 8 liv

(15) R^2 = .2608, 6 liv

F = .44 with 2/1045 df, P = .6422

Result: Retain the hypothesis.

Retention of the hypothesis indicates that there is no curvilinearity and leaves Model 15 as the final model. The effect of parent involvement is a simple linear function at all levels of pretest scores, age of the child, and mother's education.

Model 15 covers 26% of the variance in the Walker posttest scores, which corresponds to a correlation coefficient of .51. The weight on the pretest of 3.3 means that children who score 10 points higher on the Walker pretest score an average of 3.3 points higher on the Walker posttest. Children who are 100 days older score about .3 higher on the Walker posttest. Children whose mothers spent one more year in school scored about .2 higher on the Walker posttest. Parent involvement, the variable of primary interest here, produced a weight of 1.28. This means that children whose parents spend 100 more hours involved in the program obtain 1.28 higher scores on the Walker posttest.

There is some evidence of a causative link between parent involvement and Walker posttest scores. An alternate plausible hypothesis is that a self-selection factor resulted in more concerned, more nurturant, more interactive parents becoming more involved. In such a case, the

parents' characteristics rather than their involvement could explain their children's higher scores on the posttest. However, this hypothesis would also apply to the pretest, and the pretest covariance has been removed. It seems reasonable to conclude that parent involvement itself affects children's scores on the Walker.

Effects of Parent Involvement on the Cooperative

Table 4 shows means and standard deviations of the variables used in the analysis. The parents of 1,077 children averaged 52.9 hours of involvement in the program. The extent of involvement ranged from no involvement up to 424 hours. The children averaged 4 years and 5 months (1,630 days) in age at the time of pretest. The youngest was 3 years old (1,086 days) while the oldest was 5 years and 10 months old (2,144 days). Mothers had completed an average of 10.9 years of education and the families had an average income of $7,027. On the Cooperative, the children scored an average of 38.0 on the pretest and 51.6 on the posttest.

Table 4

Means and Other Statistics for Cooperative Analysis

Variable	Unit	Min.	Max.	Mean	SD
Cooperative Posttest	points	9	64	51.6	9.0
Cooperative Pretest	points	4	62	38.0	12.2
Parent Involvement	hours	0	424	52.9	54.6
Age	days	1086	2144	1630	112
Mother's Education	years	0	18	10.9	2.6
Income	dollars	1000	27000	7027	3349

Intercorrelations among the variables are shown in Table 5. The models used in this analysis are shown in Table 6.

Table 5

Correlations for the Cooperative Analysis

		1	2	3	4	5	6
1.	Cooperative Posttest	1.00	.72	.07	.13	.28	.12
2.	Cooperative Pretest		1.00	-.05	.21	.27	.23
3.	Parent Involvement			1.00	-.04	.02	-.02
4.	Age				1.00	-.02	-.02
5.	Mother's Education					1.00	.18
6.	Income						1.00

The model reduction process started with Hypothesis 1, which tested whether any of the variables had an effect on the Cooperative.

Hypothesis 1: There is no effect of any of the variables.

FULL (1) R^2 = .5598, 27 liv

REST (50) R^2 = .0000, 1 liv

F = 51.37 with 26/1050 df, P = .0001

Result: Reject the hypothesis.

The correlations in Table 5 indicated that there would be a statistically significant effect of the variables in the predictor set. Rejection of Hypothesis 1 confirms that expectation.

The first attempt to simplify the model was by testing for interaction, which was done with Hypotheses 2 and 3.

Hypothesis 2: There is no triple interaction.

FULL (1) R^2 = .5598, 27 liv

REST (2) R^2 = .5566, 22 liv

F = 1.52 with 5/1050 df, P = .1795

Result: Retain the hypothesis.

Table 6

Regression Weights[a] for Models in the Cooperative and Parent Involvement Analysis

	Models														
Vectors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
U	12[b]	14	14	21	12	21	14	43	28	18	18	24	19	18	18
P	14	13	13	12	13	12	13		5.1	13	9.2	5.2	9.1	9.2	9.3
P^2	-2.0	-1.8	-1.6	-1.5	-1.7	-1.5	-1.7			-1.7	- .56		- .54	- .56	- .56
P^3	.14	.11	.10	.09	.11	.09	.11			.11					
H	-6.9	- .23	1.5	1.2	1.4	1.1	1.4	.20	.85	1.3	1.4	.93		1.1	1.6
H^2	- .30	.15	- .19	.20	- .05	.22	- .06	- .01	.29	.03	- .04	.20		.26	
H^3	.69	.62	.11	.02	.07	.02	.07	.15	.01	.05	.07	.03			
A	.36	.12	.33		.41	.15									
A^2	.00	.00	.00		.00	.00									
A^3	- .00	- .00	- .00		- .00	- .00									
M	1.0	1.1	1.0		1.1		1.1	.52	.31	.33	1.1	1.2	1.2	1.1	1.1
M^2	- .03	- .04	- .04		- .04		- .04	.02			- .04	- .05	- .04	- .04	- .04
I	- .13	- .14	- .13												
I^2	- .47	- .00	.00												
HP	- .47	.30													
HA	.86	.15													
HM	1.2	.06													
HI	.29	.12													
H^2P	- .70	- .54													
H^2A	.00	.00													
H^2M	.11	.02													
H^2I	- .10	- .09													
PHA	.30														
PHM	.10														
PHI	.05														
HAM	- .15														
HAI	- .05														

[a]Regression weights are rounded for this Table and are not intended for individual prediction or statistical manipulation.

[b]These are raw regression weights and are not comparable from one model to another or from one weight to another within the same model.

Hypothesis 3: There is no two-factor interaction.

FULL (2) R^2 = .5566, 22 liv

REST (3) R^2 = .5503, 14 liv

F = 1.88 with 8/1055 df, P = .0595

Result: Retain the hypothesis.

Finding no triple interaction and no two-factor interaction greatly simplifies the model. Model 3 becomes the new full model.

Next, an attempt was made to eliminate age, mother's education, and income with their attendant curvilinearity.

Hypothesis 4: There is no effect of age, mother's education and income.

FULL (3) R^2 = .5503, 14 liv

REST (4) R^2 = .5372, 7 liv

F = 4.42 with 7/1063 df, P = .0001

Result: Reject the hypothesis.

An effect was found, indicating that one or more of the control variables has an effect on the Cooperative posttest. The task now is to find out which of the control variables is responsible for the significant effect.

Hypothesis 5: There is no effect of income.

FULL (3) R^2 = .5503, 14 liv

REST (5) R^2 = .5484, 12 liv

F = 2.28 with 2/1063 df, P = .1033

Result: Retain the hypothesis.

Hypothesis 6: There is no effect of mother's educational level.

FULL (5) R^2 = .5484, 12 liv

REST (6) R^2 = .5373, 10 liv

F = 13.05 with 2/1065 df, P = .0000

Result: Reject the hypothesis.

Hypothesis 7: There is no effect of age.

FULL (5) R^2 = .5484, 12 liv

REST (7) R^2 = .5482, 9 liv

F = .20 with 3/106 df, P = .8993

Result: Retain the hypothesis.

Income and age were eliminated as potential control variables. This does not necessarily mean that they are not related to the Cooperative posttest scores. It does mean that income and age are not related to the Cooperative in the presence of the other variables in the model. Mother's educational level remains as a control variable, and Model 7 is an acceptable full model.

The effect of the Cooperative pretest on posttest performance was tested next.

Hypothesis 8: There is no effect of the pretest.

FULL (7) R^2 = .5482, 9 liv

REST (8) R^2 = .0860, 6 liv

F = 364.09 with 3/1068 df, P = .0000

Result: Reject the hypothesis.

Results of testing Hypothesis 8 indicate clearly that the pretest is required as a control variable.

Hypothesis 9 was tested to determine whether pretest and mother's educational level were linear or curvilinear:

Hypothesis 9: There is no curvilinear effect.

FULL (7) R^2 = .5482, 9 liv

REST (9) R^2 = .5335, 6 liv

F = 11.55 with 3/1068 df, P = .0000

Result: Reject the hypothesis.

Rejection of Hypothesis 9 indicates the existence of curvilinearity but does not show the nature of it. Hypotheses 10, 11, and 12 were designed to accomplish this.

Hypothesis 10: There is no curvilinear effect of mother's educational level.

FULL (7) R^2 = .5482, 9 liv

REST (10) R^2 = .5457, 8 liv

F = 5.83 with 1/1068 df, P = .0159

Result: Reject the hypothesis.

Hypothesis 11: There is no third degree curvilinear effect of the pretest.

FULL (7) R^2 = .5482, 9 liv

REST (11) R^2 = .5471, 8 liv

F = 2.47 with 1/1068 df, P = .1166

Result: Retain the hypothesis.

Hypothesis 12: There is no second degree curvilinear effect of the pretest.

FULL (11) R^2 = .5471, 8 liv

REST (12) R^2 = .5365, 7 liv

F = 25.14 with 1/1069 df, P = .0000

Result: Reject the hypothesis.

Rejection of Hypothesis 10 indicates the curvilinearity of mother's educational level. Hypothesis 11 shows that there is no third degree curvilinearity of the pretest, but Hypothesis 12 shows that there is second degree curvilinearity. The resulting model (Model 11) contains the untested parent involvement vector, a tested curvilinear effect of the pretest, and a tested curvilinear effect of mother's education.

The effect of parent involvement can now be tested. If there is an effect, it does not depend on income, age, mother's educational level, or pretest score.

Hypothesis 13: There is no effect of parent involvement hours.

FULL (11) R^2 = .5471, 8 liv

REST (13) R^2 = .5369, 5 liv

F = 8.01 with 3/1069 df, P = .0001

Result: Reject the hypothesis.

Hypothesis 14: There is no third degree curvilinear effect of parent involvement hours.

FULL (11) R^2 = .5471, 8 liv

REST (14) R^2 = .5471, 7 liv

F = .13 with 1/1069 df, P = .7149

Result: Retain the hypothesis.

Hypothesis 15: There is no second degree curvilinear effect of parent involvement hours.

FULL (14) R^2 = .5471, 7 liv

REST (15) R^2 = .5468, 6 liv

F = .5277 with 1/1070 df, P = .4677

Result: Retain the hypothesis.

Rejection of Hypothesis 13 indicates that there is an effect of parent involvement. Hypotheses 14 and 15 show that the effect is linear.

Model 15 shows the size of the effect. Children whose parents are involved in the PreK program for 100 hours score 1.6 points higher on the Cooperative than children whose parents are not involved at all. This effect holds regardless of differences in the children in age at the time of the pretest, level of pretest score, family income, and mother's education.

Effects of Parent Involvement on the Peabody

Seven hundred fifty-two children were used in studying the effect of parent involvement on the Peabody. Table 7 shows that their parents averaged 59.0 hours of involvement in the program. The extent of involvement ranged from no involvement up to 424 hours. The children averaged 4 years and 6 months in age (1,643 days) at the time of pretest. The youngest was 3 years and 10 months old (1,415 days), while the oldest was 5 years and 2 months old (1,879 days). Mothers had completed an average of 10.8 years of education. The families had an average income of $6,776 per year. On the Peabody, the children obtained an average score of 36.3 on the pretest and 48.4 on the posttest.

Table 7

Means and Other Statistics for Peabody Analysis

Variable	Unit	Min.	Max.	Mean	SD
Peabody Posttest	points	5	103	48.4	14.2
Peabody Pretest	points	2	97	36.3	15.7
Parent Involvement	hours	0	424	59.0	58.3
Age	days	1415	1879	1643	107
Mother's Education	years	0	18	10.8	2.5
Income	dollars	1000	27000	6776	3173

Intercorrelations among variables are shown in Table 8.

Table 8

Correlations for the Peabody Analysis

	1	2	3	4	5	6
1. Peabody Posttest	1.00	.78	.05	.13	.40	.21
2. Peabody Pretest		1.00	-.05	.21	.41	.26
3. Parent Involvement			1.00	.02	.02	-.01
4. Age				1.00	.01	.03
5. Mother's Education					1.00	.16
6. Income						1.00

Table 9 shows the models used in testing various hypotheses in order to determine whether parent involvement affects children's performance on the Peabody posttest. Model 1, which includes all of the variables, accounted for 67% of the variance in Peabody scores. This corresponds to a correlation coefficient of .82. Hypothesis 1 tested whether any of the variables had an effect on the Peabody.

Hypothesis 1: There is no effect of any of the variables.

FULL (1) R^2 = .6659, 27 liv

REST (50) R^2 = .0000, 1 liv

F = 55.58 with 26/725 df, P = .0000

Result: Reject the hypothesis.

With a significant result of the test of Hypothesis 1, a simpler model was sought.

Table 9

Regression Weights[a] for Models in the Peabody and Parent Involvement Analysis

	Models										
Vectors	1	2	3	4	5	6	7	8	9	10	11
U	13[b]	14	10	10	11	11	11	8.9	21	15	6.6
P	19	19	18	19	19	19	19	20	7.8	12	20
P^2	-3.1	-3.0	-2.9	-2.9	-2.9	-2.9	-2.9	-3.0		- .54	-3.2
P^3	.22	.22	.22	.21	.21	.21	.21	.22			.23
H	- .90	-9.8	-4.2	- .38	-1.6	-2.4	.16	- .17	-1.6	- .18	6.7
H^2	5.3	5.9	5.0	4.0	4.5	4.5	4.5	4.9	5.9	5.1	
H^3	.70	.65	- .90	- .61	- .78	- .77	- .76	- .83	-1.0	- .86	
A	-2.5	-2.7	-1.3	-2.0	-2.2	-2.1	-2.2				
A^2	.07	.08	.01	.04	.06	.05	.08				
A^3	.01	.01	.01	.01	.01	.01	.01				
M	1.1	1.1	1.1	.97	.98	.95	.95				
M^2	- .03	- .03	- .03	- .03	- .03	- .03	- .03				
I	.42	.31	.46	.60	.47	.47	.47				
I^2	- .03	- .02	- .02	- .02	- .02	- .02	- .02				
HP	-1.2	.17		-1.0	-1.1	-1.1	-1.1				
HA	.54	1.4		.40	.44	.44					
HM	- .46	- .37		- .05	- .08						
HI	.00	.70		- .18							
H^2P	- .80	- .45									
H^2A	- .51	- .51									
H^2M	.24	.11									
H^2I	- .36	- .40									
PHA	.24										
PHM	- .03										
PHI	.15										
HAM	- .01										
HAI	.00										

[a]Regression weights are rounded for this Table and are not intended for individual prediction or statistical manipulation.

[b]These are raw score regression weights and are not comparable from one model to another or from one weight to another within the same model.

Hypothesis 2: There is no triple interaction.

FULL (1) R^2 = .6659, 27 liv

REST (2) R^2 = .6644, 22 liv

F = .65 with 5/725 df, P = .6599

Result: Retain the hypothesis.

Hypothesis 3: There is no two-factor interaction.

FULL (2) R^2 = .6644, 22 liv

REST (3) R^2 = .6543, 14 liv

F = 2.74 with 8/730 df, P = .0055

Result: Reject the hypothesis.

Retention of Hypothesis 2 shows that there is no triple interaction. A two-factor interaction involving parent participation was found in testing Hypothesis 3, indicating a parent involvement effect. Thus, the relationship between parent involvement and the Peabody posttest depends on the level of at least one other variable.

Clarification of how the other variables affect the relationship was sought through testing hypotheses 4 through 8.

Hypothesis 4: There is no curvilinear two-factor interaction.

FULL (2) R^2 = .6644, 22 liv

REST (4) R^2 = .6601, 18 liv

F = 2.37 with 4/730 df, P = .0511

Result: Retain the hypothesis.

Hypothesis 4 led to a simplification of the interaction by eliminating the possibility of curvilinear interaction.

Hypothesis 5: There is no parent involvement hours by income interaction.

FULL (4) R^2 = .6601, 18 liv

REST (5) R^2 = .6596, 17 liv

F = .96 with 1/734 df, P = .3274

Result: Retain the hypothesis.

Hypothesis 6: There is no parent involvement hours by mother's educational level interaction.

FULL (5) R^2 = .6596, 17 liv

REST (6) R^2 = .6596, 16 liv

F = .10 with 1/735 df, P = .7550

Result: Retain the hypothesis.

Hypothesis 7: There is no parent involvement hours by child's age interaction.

FULL (6) R^2 = .6596, 16 liv

REST (7) R^2 = .6592, 15 liv

F = .75 with 1/736 df, P = .3880

Result: Retain the hypothesis.

Hypothesis 8: There is no parent involvement hours by pretest level interaction.

FULL (7) R^2 = .6592, 15 liv

REST (3) R^2 = .6543, 14 liv

F = 10.59 with 1/737 df, P = .0011

Result: Reject the hypothesis.

At Hypothesis 5, it was clear that parent involvement did not interact with family income. Possible interaction with mother's educational

level was eliminated at Hypothesis 6. Interaction of parent involvement with the child's age at the time of the pretest was eliminated at Hypothesis 7. However, pretest level and parent involvement do interact, as shown by the rejection of Hypothesis 8.

Even though a parent involvement effect was found, the new full model, Model 7, might still be simplified. Hypothesis 9 was tested in an attempt to eliminate effects of age, mother's educational level, and income.

Hypothesis 9: There is no effect of child's age, mother's educational level, and income.

FULL (7) R^2 = .6592, 15 liv

REST (8) R^2 = .6530, 7 liv

F = 1.70 with 8/737 df, P = .0959

Result: Retain the hypothesis.

In one step, the model was simplified again, leaving only the pretest and parent involvement as sources of an effect on the Peabody posttest.

Hypothesis 10: There is no curvilinear pretest effect.

FULL (8) R^2 = .6530, 8 liv

REST (9) R^2 = .6247, 6 liv

F = 30.26 with 2/744 df, P = .0000

Result: Reject the hypothesis.

Hypothesis 11: There is no third degree curvilinear pretest effect.

FULL (8) R^2 = .6530, 8 liv

REST (10) R^2 = .6363, 7 liv

F = 35.69 with 1/744 df, P = .0001

Result: Reject the hypothesis.

Possible curvilinearity of the pretest on the posttest was tested and found at Hypothesis 10. Since the curvilinearity could be third degree, Hypothesis 11 was tested and was rejected, establishing that the relationship between the pretest and the posttest is a third degree curve.

Hypothesis 12: There is no curvilinear parent involvement hours effect.

FULL (8) R^2 = .6530, 8 liv

REST (11) R^2 = .6497, 5 liv

F = 2.29 with 3/744 df, P = .0766

Result: Retain the hypothesis.

Retention of Hypothesis 12 indicates that the effect of parent involvement is linear. Figure 1 shows that the effect of parent involvement is generally positive. In general, children whose parents spend more time involved in the program score higher on the Peabody posttest. The degree of the effect varies, however, depending on the pretest score. At low initial scores (20) the effect is approximately 4.3 raw score points on the Peabody posttest for every 100 hours of parent involvement. Near the average (35) of the pretest scores, the effect of parent involvement is such that 100 hours of parent involvement is associated with 2.6 points on the Peabody posttest. The change in the curvilinear effect of the pretest can be seen in Figure 1: the curvature of the plane becomes more shallow as the pretest scores become higher. Above the average, at a score of 50 points on the pretest, the effect of parent involvement is .9 of a point for every 100 hours of parent involvement.

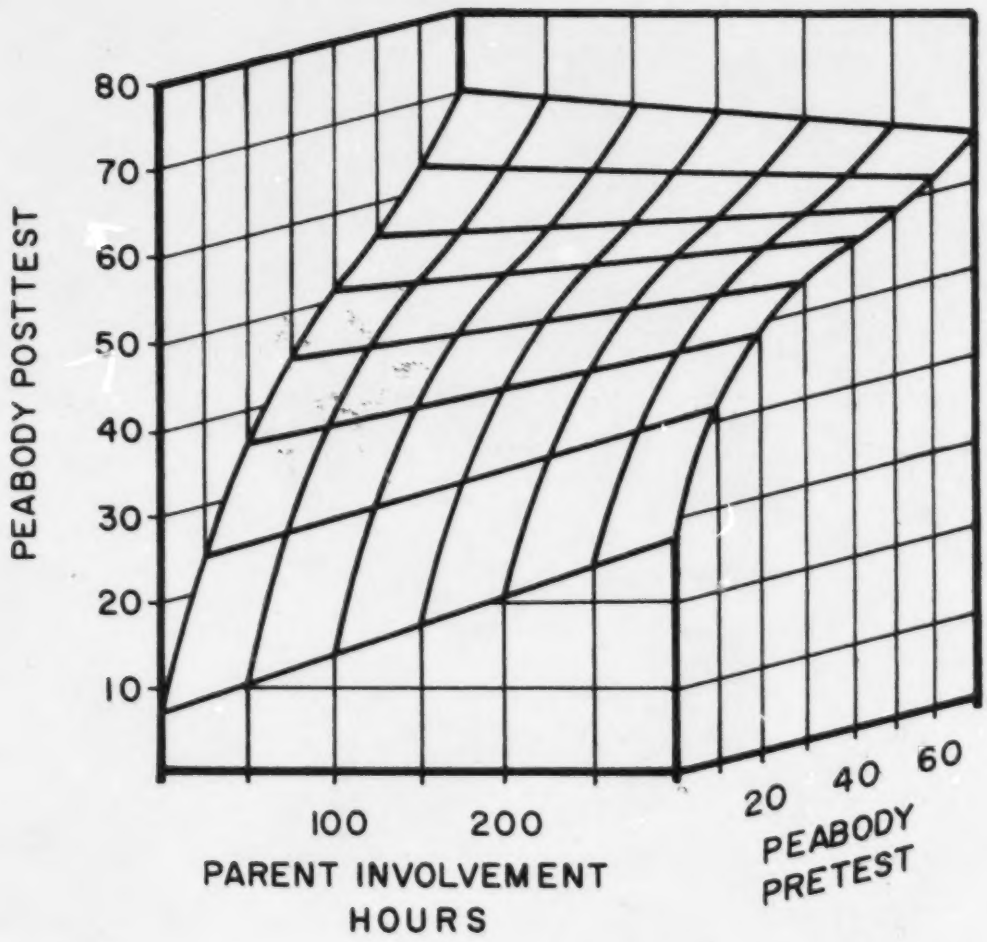

Figure 1. Effect of parent involvement on the Peabody posttest at all levels of the pretest.

SUMMARY AND CONCLUSIONS

The effects of parent involvement on three kinds of cognitive development were examined. The three dimensions of cognitive development were: (a) general reasoning, measured by the Walker Readiness Test for Disadvantaged Children; (b) school-related knowledge and skills, measured by the Cooperative Preschool Inventory; and (c) knowledge of verbal concepts, measured by the Peabody Picture Vocabulary Test.

Parent involvement included employment in the program, school visits, home visits by school personnel, group meetings, and incidental contacts such as telephone calls.

The analysis showed that parent involvement had a favorable effect on general reasoning, school-related knowledge and skills, and knowledge of verbal concepts. Finding a highly significant effect of parent involvement on three different dimensions of cognitive development is a striking result. It is persuasive evidence of the broad impact parents can have on their children's learning. In addition, parent involvement appears to affect general reasoning and school-related knowledge and skills regardless of the child's age, mother's education, family income, or level of performance at the beginning of PreK. This is additional evidence of the breadth of the effect. In the case of knowledge of verbal concepts, the effect is somewhat more limited, being strongest for children who scored lowest on the measure of verbal concepts at the beginning of PreK.

The positive findings have a number of implications for policy makers as well as for program managers. Parent involvement, as a

component of a PreK program, appears to be an effective way of overcoming some of the educational deficits of disadvantaged children. Because parent involvement of the types described here can be encouraged with relatively little expense, parent involvement should be a cost-effective way of improving children's cognitive performance. The fact that parent involvement appears to be effective across a range of mother's education, family income, and initial performance of children emphasizes the broadness of the impact. The exception to this general finding was that the effect of parent involvement on verbal concepts was greatest for children who scored lowest on the measure of verbal concepts at the beginning of PreK; this finding indicates that children who are most in need of verbal development benefit the most, a favorable finding for a program designed to serve the disadvantaged.

Some limitations to the study should be noted. The ranges of mother's education and family income are narrower than would be found in the general population because the PreK pupils are selected on the basis of several socioeconomic and educational indicators of disadvantagement. The age range, of course, is that normally found in a program designed for children the year before they enter kindergarten. The scores on the tests at the beginning of PreK may also be expected to be somewhat lower than those found in the general population. Because of these restrictions on the sample included in this study, generalizations of the effect of parent involvement can be made with greater certainty about a disadvantaged population than about the general population. More concrete information on the general population would require additional research on a less restricted sample.

A second limitation has to do with the measures used. The three tests measure three dimensions of cognitive development, as has been pointed out here. However, the cognitive domain represents only a portion of the spectrum of human functioning which the PreK program is designed to affect. Other phases of the PreK evaluation are investigating effects of the PreK program on some of these other aspects of development, such as the social competency of children and the extent to which children persevere in their learning activities.

A third limitation is based on the fact that parent involvement is largely voluntary. One possible effect of this, which the present study attempts to remedy through the use of control variables, is that the underlying causes of the parent involvement effect may be unclear. A second possible problem centers around the use of the knowledge of the effects of parent involvement. Efforts to increase parent involvement in order to improve children's learning may change the character of parent involvement (making it less voluntary, for example) with the result that the effects change. Whether this occurs could be studied in a more highly controlled experiment but was not studied in the analysis described here.

In conclusion, the impact of parent involvement may have a very practical meaning for many New York State school districts in a time of financial stress. Parent involvement appears to be a relatively inexpensive program component for districts to implement. Encouraging parents to participate in their children's education may be one highly cost-effective technique for improving children's educational performance.

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APPENDIX

Parent Involvement Forms and Directions

Directions for Completing the
RECORD OF PARENT INVOLVEMENT

Purpose

A part of the overall evaluation of the Experimental Prekindergarten Program will be to investigate the relationship between amount or type of a child's parent involvement in the Program and the results for that child on the various cognitive and affective measures.

The RECORD OF PARENT INVOLVEMENT was designed to provide a uniform method of recording the amount of time and way in which a child's parents were in contact with the program or program personnel. For the parents of each pupil, these data are to be recorded continually during the year and then summarized at the end of the year.

Recording Data During The Year

Start with one copy of the RECORD OF PARENT INVOLVEMENT for the parents of each child. Enter the child's pupil identification number in the space provided. Each time a contact is made with the program by the parent or with the parent by the program the number of hours (or minutes), the date, and the code number for the type of contact should be entered in the appropriate category. The categories are listed across the top of the chart and the types of contacts are enumerated by category below the chart.

Illustration. On November 3, 1975, the parents (both mother and father) of pupil no. 5-001 attended a pot-luck supper sponsored by the program. The supper was scheduled from 5 to 7 p.m.

After that supper, the following was recorded on pupil 5-001's RECORD OF PARENT INVOLVEMENT:

C		
Meetings		
# of Hours	Date	Type of Meeting
2 (M)	11/3	4
2 (F)	11/3	4

In this illustration it was not necessary to designate which parent attended (M- mother; F- father) for purposes of the evaluation. The designations were entered to show how each district may note additional information for that district's purposes. The child's name may also be recorded on this form since this form will not be forwarded to the State Education Department.

9/75

Summarizing Data At The End of The Year

At the end of the academic year, each district will forward to the Prekindergarten Evaluation Unit in the State Education Department the SUMMARY--RECORD OF PARENT INVOLVEMENT. On the SUMMARY, the total number of hours by type of parental involvement is recorded for each child.

Illustration. Pupil no. 5-001's parents have been actively involved in but not employed by the program throughout the year. At the end of the year, the section of the SUMMARY OF PARENTAL INVOLVEMENT for pupil no. 5-001 was completed as follows:

	A		B		C		D		E	
Pupil ID No.	School Visits		Home Visits		Meetings		Employment in Program		Other Contacts	
	# of Hours	Type of Visit	# of Hours	Visitor	# of Hours	Type of Meeting	# of Hours	Type of Employment	# of Hours	Contact
5-001	30	1	5	1	2	1		1	1	1
	10	2	18	2	6	2		2	1/2	2
		3	2	3	8	3a		3	2	3
		4	6	4	2	3b		4		4
		5			10	4				

New York State Education Department
Experimental Prekindergarten Program

Parent of
(pupil ID No.)_____

RECORD OF PARENT INVOLVEMENT

A			B			C			D			E		
School Visits			Home Visits			Meetings			Employment in Program			Other Contacts		
# of Hours	Date	Type of Visit	# of Hours	Date	Visitor(s)	# of Hours	Date	Type of Meeting	# of Hours	Date	Type of Employment	# of Hours	Date	Type of Contact

A. School Visits

1. Participation in classroom activities
2. Classroom observation
3. Conference with teacher or other staff member (inc. admission interview)
4. Field trip/picnic with children
5. Informal contact (bringing or picking up child, etc.)

B. Home Visits

1. Teacher
2. Social Worker
3. Nurse
4. Outreach worker, etc.

C. Meetings (with other parents)

1. Decision making-related to operation of the program (Parent or Policy Advisory Committee)
2. Scheduled meetings/seminars related to family living problems, community services
3. Avocational
   a. Child-rearing practices, parenting skills, home-making skills
   b. Crafts
4. Social "get togethers"--coffee klotches, luncheons, parties, pot-luck suppers

D. Employment in Program

1. Classroom aide
2. Classroom assistant
3. Food service (preparation, clean up, etc
4. Ancillary service (nurse aide, home visitor aide, family-liason-worker aide)

E. Other Contacts

1. Telephone calls
2. Incidental contacts outside school, home
3. Letters-announcements written reports sent home
4. Other-specify

New York State Education Department
Experimental Prekindergarten Program

SUMMARY--RECORD OF PARENT INVOLVEMENT

District_____ Center_____ Teacher_____

	A		B		C		D		E	
Pupil ID No.	School Visits # of Hours	School Visits Type of Visit	Home Visits # of Hours	Home Visits Visitor	Meetings # of Hours	Meetings Type of Meeting	Employment in Program # of Hours	Employment in Program Type of Employment	Other Contacts # of Hours	Other Contacts Contact
		1		1		1		1		1
		2		2		2		2		2
		3		3		3a		3		3
		4		4		3b		4		4
		5				4				
		1		1		1		1		1
		2		2		2		2		2
		3		3		3a		3		3
		4		4		3b		4		4
		5				4				
		1		1		1		1		1
		2		2		2		2		2
		3		3		3a		3		3
		4		4		3b		4		4
		5				4				
		1		1		1		1		1
		2		2		2		2		2
		3		3		3a		3		3
		4		4		3b		4		4
		5				4				
		1		1		1		1		1
		2		2		2		2		2
		3		3		3a		3		3
		4		4		3b		4		4
		5				4				